CLAIMS

What is claimed is:

1. An induction heating system, comprising:

a portable power source electrically coupleable to a fluid-cooled induction heating cable to produce a varying magnetic field; and

a portable cooling unit fluidically coupleable to the fluid-cooled induction heating cable to cool the fluid-cooled induction heating cable.

2. The system as recited in claim 1, comprising a fluid-cooled induction heating cable.

3. The system as recited in claim 1, comprising a portable power source controller.

4. The system as recited in claim 3, wherein the portable power source controller is operable to control power from the power source to produce a desired temperature profile in the workpiece.

5. The system as recited in claim 2, wherein the induction heating system is operable to relieve stress from the workpiece after welding.

6. The system as recited in claim 1, comprising a wheeled cart, wherein the power source and cooling unit are disposed on the wheeled cart.

7. The system as recited in claim 6, wherein a portable power source controller is disposed on the wheeled cart.

8. The system as recited in claim 1, comprising a temperature feedback device operable to provide an electrical signal representative of workpiece temperature.

9. A method of operating an induction heating system, comprising:

transporting a portable power source and portable fluid cooling unit to the on-site location;

disposing thermal insulation around a portion of the workpiece;

routing a fluid-cooled induction heating cable over the thermal insulation around the portion of the workpiece;

coupling the fluid-cooled induction heating cable to the portable power source and portable fluid-cooling unit; and

automatically controlling the operation of the portable power source to inductively heat the workpiece to reduce stress in the workpiece.

10. The method as recited in claim 9, wherein transporting comprises transporting a portable power source controller operable to automatically control the portable power source with the portable power source and the portable fluid-cooling unit.

11. The method as recited in claim 10, wherein transporting comprises transporting the portable power source, portable power source controller, and portable fluid-cooling unit on a wheeled cart.

12. The method as recited in claim 9, wherein automatically controlling comprises programming the portable power source controller to raise workpiece temperature at a first specified rate during a first portion of the sequence of inductive heating operations.

13. The method as recited in claim 12, wherein automatically controlling comprises programming the power source controller to raise workpiece temperature at a second specified rate during a second portion of the sequence of inductive heating operations.

14. The method as recited in claim 12, wherein automatically controlling comprises programming the power source controller to lower workpiece temperature at a third specified rate during a third portion of the sequence of inductive heating operations.

15. The method as recited in claim 9, wherein disposing comprises disposing a first insulation blanket around a first portion of the workpiece and disposing a second insulation blanket around a second portion of the workpiece, the first and second portion being on opposite sides of the welded portion of the workpiece.

16. The method as recited in claim 15, wherein routing comprises routing a first portion of the fluid-cooled induction heating cable over the first insulation blanket and routing a second portion of the fluid-cooled induction heating cable over the second insulation blanket

17. The method as recited in claim 15, wherein disposing comprises disposing a third insulation blanket around the welded portion of the workpiece after welding.

18. The method as recited in claim 15, wherein routing comprises coupling the fluid-cooled induction heating cable to the portable power source via an extension cable operable to convey electricity and cooling fluid.

19. A method of shrink fitting a first component and a second component, comprising:

routing a fluid-cooled induction heating cable around the first component;

electrically coupling the fluid-cooled induction heating cable to a power source;

fluidicly coupling the fluid-cooled induction heating cable to a fluid-cooling unit;

operating the power source to inductively heat the first component to expand the first component; and

positioning the first and second components in relation to each other so that a first portion of the first component is disposed over a second portion of the second component; and

cooling the first component to contract the first portion of the first component over the second portion of the second component.

20. The method as recited in claim 19, comprising transporting the power source and fluid-cooling unit on a wheeled cart adapted to transport the power source and fluid-cooling unit.

21. The method as recited in claim 19, comprising disposing an insulation blanket around the first component between the workpiece and the induction heating cable.

22. The method as recited in claim 21, comprising disposing a temperature feedback device between the workpiece and the insulation blanket.

23. The method as recited in claim 19, wherein cooling comprises removing power from the induction heating cable.

24. The method as recited in claim 19, wherein operating comprises controlling the power source automatically with a programmable power source controller.

25. A method of coating a portion of a workpiece, comprising:

applying a temperature sensitive material on a first portion of the workpiece;

routing a fluid-cooled induction heating cable around a second portion of the workpiece;

coupling the fluid-cooled induction heating cable to a power source operable to produce a varying current through the fluid-cooled induction heating cable and a fluid-cooling unit operable to provide a flow of cooling fluid through the fluid-cooled induction heating cable; and

operating the power source to inductively heat the workpiece so that heat is transferred from the second portion of the workpiece to the first portion of the workpiece to activate the temperature sensitive coating.

26. The method as recited in claim 25, comprising transporting the power source and fluid-cooling unit to the workpiece.

27. The method as recited in claim 26, wherein transporting comprises securing the power source and fluid-cooling unit to a moveable cart.

28. A method of repairing a first portion of pipe conveying a fluid, comprising:

routing a first portion of a fluid-cooled induction heating cable around the pipe;

disposing a repair member over the first portion of the pipe;

routing a second portion of a fluid-cooled induction heating cable around the repair member;

operating at least one power source to inductively heat the pipe and the repair member; and

welding the repair member to the pipe.

29. The method as recited in claim 28, wherein the first portion of a fluid-cooled induction heating cable is coupled to a first power source and the second portion of a fluid-cooled induction heating cable is coupled to a second power source.

30. The method as recited in claim 28, comprising disposing first and second portions of insulation around the pipe on opposite sides of the first portion of the pipe.

31. The method as recited in claim 28, wherein the repair member is a plurality of repair members adapted to extend around the pipe, wherein welding comprises welding the repair members to each other around the pipeline.

32. The method as recited in claim 29, wherein operating comprises operating the first power source to inductively heat the pipe and operating the second power source to inductively heat the repair member.

33. The method as recited in claim 28, comprising transporting the power source and a fluid-cooling unit to the pipe on a moveable assembly adapted to transport the power source and fluid-cooling unit.

34. A method of polishing a shaft, comprising:

routing a fluid-cooled induction heating cable around the shaft;

coupling the fluid-cooled induction heating cable to a power source operable to produce a varying current through the fluid-cooled induction heating cable and a fluid-cooling unit operable to provide a flow of cooling fluid through the fluid-cooled induction heating cable;

operating the power source to induce heat in the shaft;

applying a layer of a polishing compound to the shaft; and

polishing the shaft.

35. The method as recited in claim 34, comprising disposing a thermal induction blanket around the shaft before routing the fluid-cooled induction heating cable around the shaft.

36. The method as recited in claim 34, comprising a power source controller operable to control operation of the power source to raise the temperature of the shaft at a desired rate of temperature increase.

37. The method as recited in claim 34, comprising removing the induction heating cable prior to applying a layer of polishing compound to the shaft.

38. The method as recited in claim 34, wherein polishing comprises polishing the shaft in a single pass down the length of the shaft.

39. A method of surface hardening a workpiece, comprising:

routing a fluid-cooled induction heating cable around the workpiece;

coupling the fluid-cooled induction heating cable to a power source operable to produce a varying current through the fluid-cooled induction heating cable and a fluid-cooling unit operable to provide a flow of cooling fluid through the fluid-cooled induction heating cable;

operating the power source to inductively heat the workpiece to harden a surface of the workpiece.

40. The method as recited in claim 39, comprising disposing thermal insulation intermediate the workpiece and the fluid-cooled induction heating cable.

41. The method as recited in claim 38, wherein operating comprises controlling the operation of the power source automatically using a programmable power source controller.

42. The method as recited in claim 38, wherein operating comprises controlling the power source to inductively heat the surface of the workpiece automatically according to a specified surface hardening temperature profile.

43. The method as recited in claim 38, comprising transporting the power source and fluid-cooling unit to the workpiece using a moveable cart.

44. A method of annealing a workpiece, comprising:

routing a fluid-cooled induction heating cable around the workpiece;

coupling the fluid-cooled induction heating cable to a power source operable to produce a varying current through the fluid-cooled induction heating cable and a fluid-cooling unit operable to provide a flow of cooling fluid through the fluid-cooled induction heating cable;

operating the power source to inductively heat the workpiece to a desired temperature;

maintaining the workpiece at the desired temperature for a desired period of time;

controlling the operation of the power source to reduce the temperature of the workpiece to a lower temperature at a desired rate of temperature decrease.

45. The method as recited in claim 44, comprising coupling the power source to a power source controller operable to control the operation of the power source automatically.

46. The method as recited in claim 44. comprising moveable cart operable to transport the power source, power source controller, and fluid-cooled induction heating unit to the workpiece.

47. A portable heating system, comprising:

a power source operable to apply power to heat a workpiece;

a power source controller operable to control the heating of a workpiece in response to programming instructions provided by a user to produce a desired temperature profile in the workpiece; and

a cart operable to transport the power source and power source controller to the workpiece.

48. The system as recited in claim 47, wherein the system is an induction heating system.

49. The system as recited in claim 47, comprising a fluid-cooled induction heating cable.

50. The system as recited in claim 47, comprising a cooling unit operable to provide a flow of cooling fluid, the cooling unit being disposed on the cart.

51. The system as recited in claim, 47, comprising a temperature feedback device operable to produce a signal representative of workpiece temperature to the power source controller.

52. The system as recited in claim 47, wherein the power source controller uses PID control.

53. The system as recited in claim 47, wherein the power source controller uses PI control.

54. The system as recited in claim 47, wherein the system is operable to raise the temperature of a workpiece to a first temperature and lower the temperature of the workpiece from the first temperature to a second temperature at a desired rate.

55. The system as recited in claim 47, comprising an insulation blanket having a visible line to enable the insulation blanket to be aligned with a weld joint.

56. A method of inductively heating a workpiece, comprising:

disposing a movable framework over the workpiece;

routing a flexible induction heating cable around the moveable framework;

applying power to the flexible induction heating cable; and

moving the movable framework and flexible induction heating cable along the workpiece to inductively heat the workpiece.